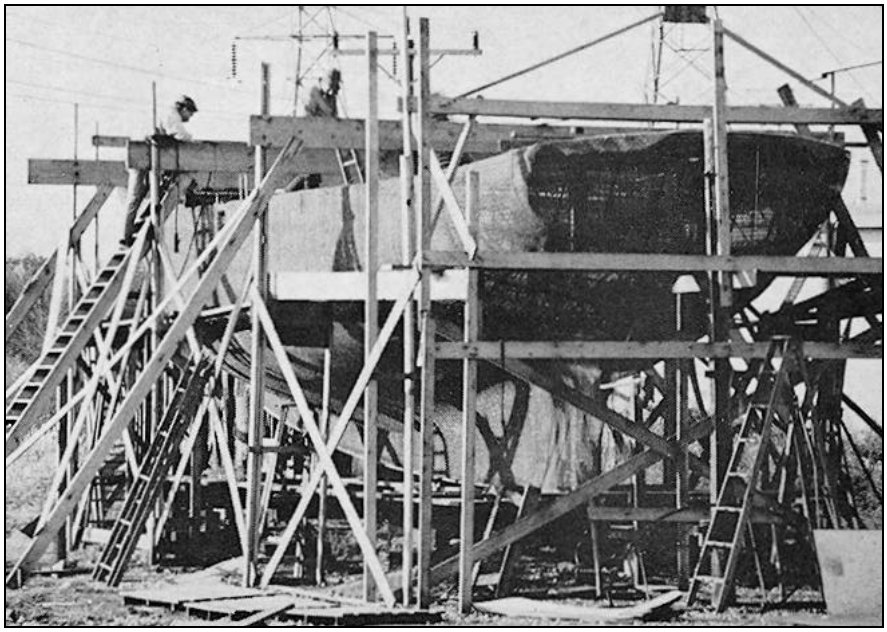
Building a concrete sail boat

Their lifelong love for sailing launched a father and son on a do-it-yourself boat-building project.



Fabrication of reinforcing rods and wire mesh has been completed on the Ekelmanns' boat and it is ready for application of mortar, which will be done when the weather becomes warm enough for this operation.

A sail boat made of ferro-cement will fulfill a long-time ambition of a father and son to build their own boat. They—Russell Ekelmann and his son, Tom, of Highland Park, Illinois—acquired a love for sailing during a lifetime of living on the shore of Lake Michigan. Nothing would please them more, they have long felt, than to build their own ship and sail it.

When the Ekelmanns' 53-foot gaff-rigged schooner is launched in Waukegan Harbor, hopefully in late July or August, it will be the first concrete sailing craft to make its maiden voyage on the Great Lakes. If their vessel lives up to expectations, father and son plan to take to the sea, possibly for a round-the-world voyage. And when they return, the amateur ship builders will consider going commercial with concrete boats.

While the younger Ekelmann was serving in the navy aboard the U.S.S. Manatee during the Viet Nam war, his father was researching concrete boats. He came to the conclusion that ferro-cement, a comparatively new type of reinforced concrete, was an ideal material for boats.

Reinforced concrete boats are not new. The United States and other countries used concrete ships during both world wars to alleviate the shortage of steel. Actually, there is a concrete sloop built in 1867 still in service on a pond at the Amsterdam Zoo.

Many advantages

In ferro-cement the inner steel fabric predominates, and concrete seals the matrix and seals the steel. This material resists corrosion, rot, fire and worms. It can be as light or lighter than steel.

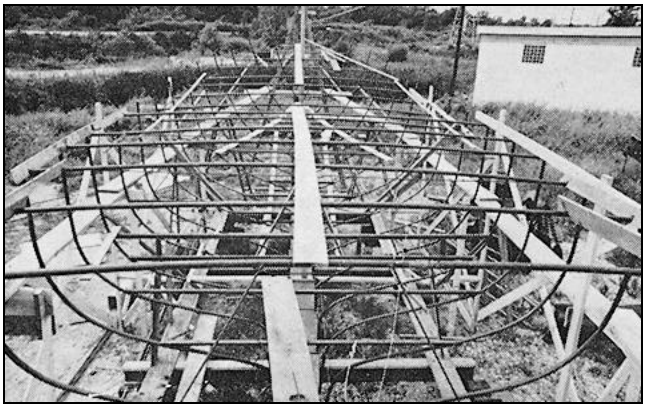
Ferro-cement will bend considerably and has high impact resistance. It requires practically no maintenance, and dirt or other impurities can be hosed off the hull with water. It is the only material that can be permanently repaired below the waterline.

The first ferro-cement boat was a 165-ton motor yacht with a 1⅜-inch-thick hull, built in 1945 by famed Italian architect Pier Luigi Nervi. Three years later he built a ferro-cement ketch with a ½-inch-thick hull.

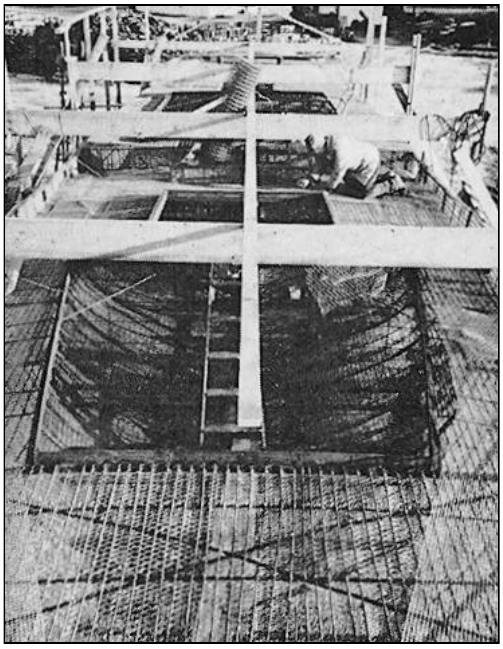
Consult PCA

Upon Tom's discharge from the service, the Ekelmanns launched into their boat-building project. They consulted with engineers at the Portland Cement Association's research and development laboratories and obtained working drawings from Thomas Colvin, a naval architect with extensive experience in designing ferro-cement boats.

The Ekelmanns originally thought in terms of wood for their boat but switched to ferro-cement because of the latter material's lower cost, equal seaworthiness, and easier maintenance. Ferro-cement boats are low in cost for two reasons: the materials are cheap and the labor involved in construction is minimal. The Ekelmanns estimate the cost of materials for the hull of their boat to be about $10,000, with the entire cost of the boat running close to $35,000.



The boat is shown at a very early stage of construction, when the hull was framed with 1-inch water pipe bent to proper shape.



Work progressed as mesh was applied above deck.

Russell and Tom Ekelmann obtained space for their "boatyard" in the rear lot of a Highland Park materials dealer, only a few blocks from their home. They laid the keel by August 2 of last year and completed the fabrication of reinforcing steel for the entire hull before the advent of winter. The keel is made of 1¼-inch steel plate, and the hull frames are fabricated of 1-inch water pipe bent to shape and welded.

Horizontal reinforcing bars were laid around the hull and welded into place. Several layers of wire cloth with ½- to 1-inch openings were laid both on the outside and inside of the horizontal reinforcing rods and wired in place. Reinforcing consisted of ¼-inch bars on 2-inch centers horizontally with ⅜-inch bars 1 foot on centers vertically, one layer of ½-inch hardware cloth, three layers of chickenwire mesh on the outside, and four layers of chickenwire mesh on the inside, all wired together.

As we go to press, the Ekelmanns are awaiting the warmth of spring before applying mortar, thus avoiding freezing and permitting proper curing of the ferro-cement. In the meantime, plastic sheets protect the keel and hull while the shipbuilders occupy themselves sewing sails and fashioning the masts.

To use thick mortar

The Ekelmanns will use a fairly thick mortar containing a shrinkage-compensating portland cement and clean, sharp sand, 1 part cement to 1½ parts sand. The mortar will be pumped through the mesh from the inside to the outside and troweled smooth on the outside by a skilled plasterer to a depth of only ⅛ inch. The entire hull, including reinforcing, will have a thickness of only ⅞ inch.

Watertightness in ferro-cement is achieved simply by the density of the mortar. Density is reached by the use of very fine sand particles used in conjunction with the cement paste. The paste completely enclosed the fine particles gluing them into a solid mass. Further density and strength is achieved by the introduction into this mix of the rod and mesh framework. Serving a secondary purpose, the metals further prevent the mortar from cracking—a normal occurrence in the use of a rich mix.

When plastering of the boat is complete, the hull will be protected from the elements and cured for a period of two to four weeks. Following the curing period, the hull can be primed and painted like any other boat. Work can then proceed inside the hull.

Although the curing process is nominally complete after two to three weeks, ferro-cement actually goes on curing slowly for decades—and a 50-year-old ferro-cement boat will be stronger than when she was new.

The Ekelmanns' schooner will have an over-all length of 53 feet, with a 42-foot waterline, a 15-foot beam, and a 5½ -foot draft. It will carry two masts rising 55 feet above the waterline and will be equipped with a diesel engine for auxiliary power.

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